
तापीय उष्मारोधी के लिए सेलुलर
कंक्रीट — विशिष्टि

(पहला पुनरीक्षण)

Cellular Concrete for Thermal
Insulation — Specification

(First Revision)

ICS 91.100.60

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भारतीय मानक ब्यूरो

BUREAU OF INDIAN STANDARDS

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FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Thermal Insulation Sectional Committee had been approved by the Chemical Division Council.

This standard was first published in 1972. During this revision, amendments to the previous version has been included as well as an attempt is being made to incorporate changes according to the latest developments in this field.

Cellular concrete is a versatile building insulation material due to its high compatibility with concrete and masonry which are popular construction materials. Its light weight and higher thermal insulation value compared to normal concrete permits its use to higher thickness.

When cast *in-situ*, it can be applied on flat roofs for a joint-free thermal insulation. It is also common for this material which is primarily an insulation, to be featured as a provision to create required slope for easy water evacuation from roofs.

Use of cellular concrete on roof required protection from damage due to point loads (like from foot-steps) by providing a layer of screeding which is applied directly on freshly foamed and set surface. It is also essential to provide high quality water proofing after provisions of such screed topping to prevent water ingress which would impair the insulation value of cellular concrete.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

CELLULAR CONCRETE FOR THERMAL INSULATION — SPECIFICATION

(*First Revision*)

1 SCOPE

This standard prescribes the requirements and the methods of sampling and test for cellular concrete for thermal insulation.

2 REFERENCES

The standards listed below contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

<i>IS No.</i>	<i>Title</i>
269 : 2015	Ordinary Portland cement — Specification (<i>sixth revision</i>)
432 (Part 1) : 1982	Specification for mild steel and medium tensile steel bars and hard-drawn steel wire for concrete reinforcement: Part 1 Mild steel and medium tensile steel bars (<i>third revision</i>)
455 : 2015	Portland slag cement— Specification (<i>fifth revision</i>)
1366 : 2002/ ISO 1207 : 1992	Slotted cheese head screws — product grade A (<i>third revision</i>)
3346 : 1980	Method for the determination of thermal conductivity of thermal insulation materials (two slab, guarded hot-plate method) (<i>first revision</i>)
4905 : 2015/ ISO 24153 : 2009	Random sampling and randomization procedures (<i>first revision</i>)
5688 : 1982	Methods of test for preformed block-type and pipe covering-type thermal insulation (<i>first revision</i>)
9489 : 1980	Method of test for thermal conductivity of thermal insulation materials by means of heat flow meter

3 TYPES AND GRADES

3.1 Types

There shall be two types of the material depending on

the manner of manufacture, namely:

- a) *Type 1* — Material in the form of precast blocks, with or without reinforcement, manufactured under controlled conditions in a plant and autoclaved with high pressure steam.
- b) *Type 2* — Materials cured under natural conditions (that is, under ambient pressure and temperature). The material may be either cast *in-situ* directly or may be in the form of blocks which are cast in moulds and assembled at site.

3.2 Grades

Each of these two types of the material shall have three grades, namely:

- a) *Grade A* — Light weight cellular concrete;
- b) *Grade B* — Medium weight cellular concrete; and
- c) *Grade C* — Heavy weight cellular concrete.

4 MATERIALS

4.1 Cement

Portland cement conforming to IS 269 or IS 455 shall be used.

4.2 Aggregate

A variety of siliceous fines, such as ground quartz, sand, shale, fly ash and granulated slag may be used in the manufacture of cellular concrete.

4.3 Foaming Agents

Foaming agents formulated from resins, surface active agents, fine aluminium powder, zinc dust, calcium carbide, calcium hypochlorite, etc, may be used for gassing the concrete.

4.4 Water

The water used for making the concrete shall be clean and free from any matter injurious to the durability of cellular concrete.

4.5 Reinforcements

Reinforcement, if provided may be any of the following:

- a) Plain mild steel bars conforming to Grade 1 of IS 432 (Part 1).
- b) Welded mesh (wire fabric) conforming to IS 1366.

5 REQUIREMENTS

5.1 Description

Cellular concrete is a light weight concrete formed by producing gas or air bubbles in slurry composed of cement, sand and other permissible aggregates.

5.2 Density

The average bulk density of the three grades of the material shall be as given in Table 1, when tested in accordance with the method prescribed in 4 of IS 5688.

Table 1 Average Bulk Density of Cellular Concrete
(Clause 5.2)

Sl No.	Grade	Density kg/m ³
(1)	(2)	(3)
i)	A	Minimum 320
ii)	B	321 to 400
iii)	C	401 to 500

5.3 Crushing Strength

The crushing strength of dry cellular concrete shall be as given in Table 2 when tested in accordance with the method as prescribed in 6 of IS 5688.

Table 2 Crushing Strength of Dry Cellular Concrete
(Clause 5.3)

Sl No.	Grade	Strength, kg/cm ² , Min	
		Type 1	Type 2
(1)	(2)	(3)	(4)
i)	A	7.0	2.5
ii)	B	10.0	4.5
iii)	C	15.0	8.0

5.4 Capillary Absorption

The capillary absorption shall not exceed 20 percent in case of Type 1 cellular concrete when tested in accordance with the method prescribed in Annex A.

5.5 Thermal Conductivity

The thermal conductivity of the material shall be as given in Table 3, when determined in accordance with the method prescribed in IS 3346 or IS 9489.

Table 3 Thermal Conductivity of Cellular Concrete
(Clause 5.5)

Sl No.	Grade	Thermal Conductivity, in mW/cm °C at 50°C Mean Temperature Max
(1)	(2)	(3)
i)	A	0.7
ii)	B	0.85
iii)	C	1.0

5.6 Dimensions Tolerances

The dimensions of precast cellular concrete blocks, Type 1 and Type 2 shall be as agreed to between the purchaser and the supplier. The blocks shall have a tolerance of ± 3 percent or ± 10 mm (whichever is lower) on length and width and ± 3 mm on thickness.

6 MARKING

6.1 Each block shall be marked with the manufacturer's identification mark or initials and the type and grade of the material.

6.2 BIS Certification Marking

The blocks may also be marked with Standard Mark.

6.2.1 The use of the Standard mark is governed by the provision of *Bureau of Indian Standards Act, 2016* and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

7 SAMPLING

The method of sampling shall be as prescribed in Annex B.

ANNEX A

(Clause 5.4)

CAPILLARY ABSORPTION TEST**A-1 TEST SPECIMENS**

Three test specimens 4 cm × 4 cm base and 16 cm height shall be prepared.

A-2 PROCEDURE

Dry six specimens in an oven at $105 \pm 5^\circ\text{C}$ and weigh them. Suspend them in a water-bath such that the water level is 1 cm above the base of the specimen. It may be necessary to replenish water in order to compensate for the drop in level due to absorption by the specimens.

Allow them to stand for 48 h in the water, remove carefully, remove excess water on the surfaces and re-weigh.

A-3 CALCULATION

Capillary absorption, percent by mass = $\frac{w}{W} \times 100$

where

w = increase in mass of the specimen, in g ; and

W = mass of the specimen after drying, in g.

ANNEX B

(Clause 7)

SAMPLING OF CELLULAR CONCRETE BLOCKS**B-1 LOT**

In a consignment, cellular concrete of the same type and grade and manufactured approximately in the same period shall be grouped to form a lot. If it is in the form of blocks, a lot shall be made up of not more than 1 000 blocks.

If the material is *in-situ*, a batch produced from not more than 10 tonne of raw materials shall constitute a lot. If the material is transported in trucks and received as such, the material of each truck load may also be termed as a lot.

B-2 SCALE OF SAMPLING

B-2.1 Each lot shall be tested for all requirements of this specification.

B-2.2 If the material is received in bulk, samples shall be drawn from different portions so as to be representative of the lot. It is recommended that at least 20 increments, each weighted about 1 kg be taken from the bulk and kept for conducting various tests.

B-2.3 If the lot is made up of precast blocks, the numbers of blocks to be sampled depends upon the size of the lot and shall be in accordance with col 1 and col 2 of Table 4.

B-2.3.1 The sample blocks shall be selected at random with the help of random number tables. For guidance IS 4905 may be referred.

Table 4 Scale of Sampling for Cellular Concrete Blocks
(Clause B-2.3)

Sl No.	Lot Size	Sample size (Blocks to be Sampled)	Permissible No. of Defectives (Visual and Dimensional Requirements)
(1)	N (2)	n (3)	a (4)
i)	Up to 100	5	0
ii)	100 to 300	8	0
iii)	301 to 500	13	0
iv)	501 to 1 000	20	1

B-3 NUMBER OF TESTS AND CRITERIA FOR CONFORMITY**B-3.1 Visual and Dimensional Requirements**

In respect of visual and dimensional characteristics (see 5.6), the sample blocks selected according to **B-2** shall be examined. The lot shall be accepted only, if the number of defective blocks in the sample does not exceed the permissible number (a) given in col 4 of Table 4.

B-3.2 Preparation of Samples for Other Tests

In case of the material in bulk form, the increments shall be grouped into four portions and the material in each portion shall be combined thoroughly to give a test sample. There will thus be four test samples to be used for different tests. In the case of precast blocks four test samples shall be prepared from the sample blocks selected under **B-2**.

B-3.3 Density and Crushing Strength

Four tests shall be conducted for each of the two characteristics on test samples or blocks mentioned

in **B-3.2**. No failure shall occur if the lot is to be accepted.

B-3.4 Thermal Conductivity

One test shall be conducted for this characteristic on test samples prepared under **B-3.2** and after drying at $105 \pm 5^\circ\text{C}$. The test shall not fail for acceptance of the lot.

B-3.5 Capillary Absorption

One test shall be conducted on any one of the test samples and the lot shall be accepted, if the test result complies with the requirement given in **5.4**.

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